DEPARTMENTS.

SOLUTIONS OF PROBLEMS.

ALGEBRA.

319. Proposed by C. N. SCHMALL, New York City.

A man desires to purchase eggs at 5 cents, 1 cent, and $\frac{1}{2}$ cent, respectively, in such numbers that he will obtain 100 eggs for a dollar. How many solutions in rational integers?

I. Solution by G. B. M. ZERR, A. M., Ph. D., Philadelphia, Pa.; J. W. CLAWSON, Ursinus College, Collegeville, Pa.; V. M. SPUNAR, Pittsburg, Pa.; and H. C. FEEMSTER, York College, York, Neb.

Let x=number at 5 cents, y=number at 1 cent, z=number at $\frac{1}{2}$ cent.
Then $x+y+z=100=5x+y+\frac{1}{2}z$...(1, 2).
Eliminating z we get the indeterminate equation, $9x+y=100$.
$\therefore y=100-9x$.
This equation gives us eleven integral solutions, as follows:
x=1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11.
y=91, 82, 73, 64, 55, 46, 37, 28, 19, 10, 1.
z=8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88.

Also solved by S. F. Norris, S. A. Corey, B. Kramer, J. Scheffer, T. J. Fitzpatrick, and Theodore L. DeLand.

II. Solution by PROFESSOR S. F. NORRIS, Baltimore City College, Baltimore, Md., and J. E. SANDERS, Weather Bureau, Chicago, Ill.

$$\text{Average price}=1\left\{\begin{matrix}5\\1\\\frac{1}{2}\end{matrix}\right\}\left|\begin{array}{r|r|r|r|r|r|r|r|r|r|r}1&2&3&4&5&6&7&8&9&10&11\\91&82&73&64&55&46&37&28&19&10&1\\8&16&24&32&40&48&56&64&72&80&88\end{array}\right|.$$

NOTE. This is the method used in many arithmetics. For the process of reasoning see *e. g.*, Ray's *New Higher Arithmetic*, p. 333, subject, Alligation. ED. F.

320. Proposed by FRANCIS RUST, C. E., Pittsburg, Pa.

Solve for t, $\cos t=m\cos 2t$.

Solution by T. J. FITZPATRICK, Lamoni, Iowa; S. A. COREY, Hiteman, Iowa; J. E. SANDERS, Weather Bureau, Chicago, Ill.; and B. KRAMER, E. M., N. S., Pittsburg, Pa.

$$\cos t=m\cos 2t=m(\cos^2 t-\sin^2 t)=m(\cos^2 t-1+\cos^2)=2m\cos^2 t-m.$$

$$2m\cos^2 t-\cos t=m.$$

$$\cos^2 t-\frac{1}{2m}\cos t=\tfrac{1}{2}.$$

$$\cos^2 t-\frac{1}{2m}\cos t+\frac{1}{16m^2}=\tfrac{1}{2}+\frac{1}{16m^2}=\frac{8m^2+1}{16m^2}.$$

$$\cos t-\frac{1}{4m}=\pm\frac{1}{4m}\sqrt{[(8m^2+1)]}.$$